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X-38

Back to the Future For a Spacecraft Design

Engineers at NASA's Dryden Flight Research Center, Edwards, Calif., and the Johnson Space Center, (JSC) Houston, Texas, are flight-testing the X-38, a prototype spacecraft that could become the first new human spacecraft built in the past two decades that travels to and from orbit. The vehicle is being developed at a fraction of the cost of past human space vehicles. The goal is to take advantage of available equipment, and already developed technology for as much as 80 percent of the spacecraft's design.

B-52 and X-38 in flight

Using available technology and off-the-shelf equipment significantly reduces cost. The original estimates to build a capsule-type crew return vehicle (CRV) were more than $2 billion in total development cost.

According to NASA project officials, the X-38 concept and four operational vehicles will be built for approximately one quarter of the original $2 billion cost.

Current Status

Atmospheric drop tests of the X-38 at the Dryden Flight Research Center are underway and will continue for the next two years. Three test vehicles will be used. The drop tests will eventually increase in altitude to 50,000 feet and will include longer flight times for the test craft before its parafoil is deployed.

X-38 glides to landing March 12, 1998

Full-scale, unpiloted “captive carry” flight tests began at Dryden in July 1997 in which the vehicle remained attached to the NASA B-52 aircraft. Unpiloted free-flight drop tests from the B-52 began in March 1998. In 2000, an unpiloted space test vehicle is planned to be deployed from a Space Shuttle and descend to a landing on earth. The X-38 crew return vehicle is targeted to begin operations aboard the International Space Station (ISS) in 2003.

Project Goals

The immediate goal of the innovative X-38 project, is to develop the technology for a prototype emergency CRV, or lifeboat, for the ISS. The project also intends to at develop a crew return vehicle design that could be modified for other uses, such as a possible joint U.S. and international human spacecraft that could be launched on the French Ariane 5 booster.

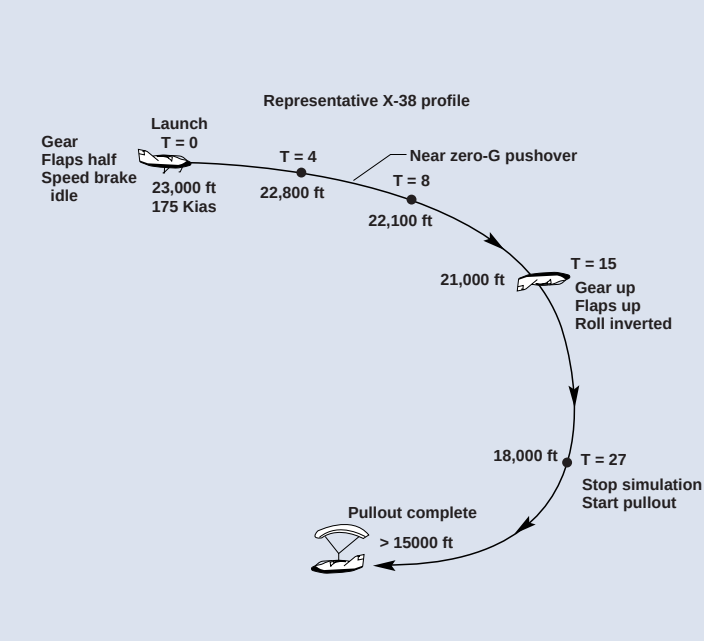
In the early years of the International Space Station, a Russian Soyuz spacecraft will be attached to the station as a CRV. But, as the size of the crew aboard the station increases, a return vehicle that can accommodate up to six passengers will be needed. The X-38 design uses a lifting body concept originally developed by the Air Force’s X-24A project in the mid-1970’s. After the deorbit engine module is jettisoned, the X-38 would glide from orbit unpowered like the Space Shuttle and then use a steerable, parafoil parachute, a technology recently developed by the Army, for its final descent to landing. Its landing gear would consist of skids rather than wheels.

Technology

Off-the-shelf technology doesn’t mean it is old technology. Many of the technologies being used in the X-38 have never before been applied to a human spacecraft.

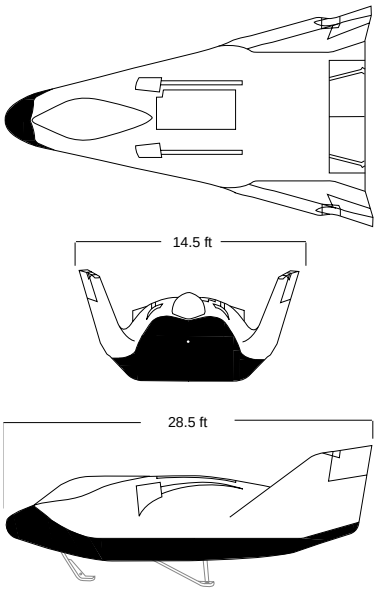
The X-38 flight computer is commercial equipment that is currently used in aircraft, and the flight software operating system is a commercial system already in use in many aerospace applications. The video equipment on the atmospheric test vehicles is existing equipment, some of which has already flown on the Space Shuttle for other NASA experiments. The electromechanical actuators that are used on the X-38 come from a previous joint NASA, Air Force, and Navy research and development project.

An existing special coating developed by NASA will be used on the X-38 thermal tiles to make them more durable than the tiles used on the Space Shuttle. The X-38’s primary navigational equipment, the Inertial Navigation System/Global Positioning System, is a unit already in use on Navy fighters.



Future Plans

Although the design could one day be modified for other uses such as a crew transport vehicle, the X-38 would strictly be used as a CRV in its current design. It is baselined with only enough life support supplies to last about nine hours flying free of the space station in orbit. The spacecraft’s landing will be totally automated, although the crew will be able to switch to backup systems, control the orientation in orbit, pick a deorbit site, and steer the parafoil, if necessary. The X-38 CRV has a nitrogen gas-fueled attitude control system and uses a bank of batteries for power. The spacecraft will be 28.5 feet long, 14.5 feet wide, and weigh about 16,000 pounds.

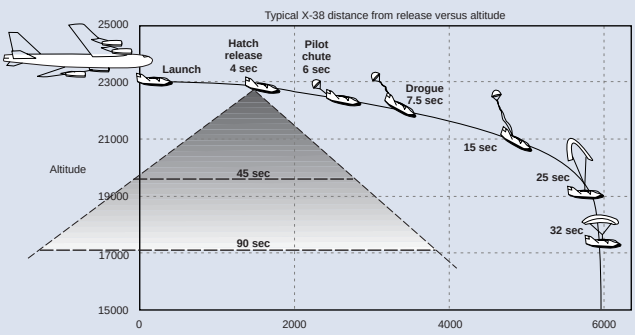


Three view of X-38

Team Approach

About 100 people are currently working on the project at Johnson, Dryden, and the Langley Research Center in Hampton, Va. This is the first time a prototype vehicle has been built-up in-house at JSC, rather than by a contractor; an approach that has many advantages. By building up the vehicles in-house, engineers have a better understanding of the problems contractors experience when they build vehicles for NASA. JSC's X-38 team will have a detailed set of requirements for the contractor to use to construct the CRVs for the ISS. This type of hands-on work was done by the National Advisory Committee on Aeronautics (NACA), NASA's predecessor, before the space age began.

An, in-house development study of the X-38 concept began at JSC in early 1995. In the summer of 1995, early flight tests were conducted of the parafoil concept by dropping platforms with a parafoil from an aircraft at the Army's Yuma Proving Ground, Yuma, Arizona. In early 1996 a contract was awarded to Scaled Composites, Inc., of Mojave, Calif. to build three full-scale atmospheric test airframes. The first vehicle airframe was delivered to JSC in September 1996, where it was outfitted with avionics, computer systems, and other hardware in preparation for the flight tests at Dryden. A second vehicle was delivered to JSC in December 1996.



X-38 team members at work

Dryden conducted model flights in 1995. The 1/6 scale-model of the CRV spacecraft using a parafoil parachute system was flown 13 times. The results showed that the vehicle had good flight control characteristics and also demonstrated good slideout characteristics

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